How Can We Use VCIS?

- Local, state, tribal, or federal managers of smoke or other pollutants can use the ventilation index data.
- Maps and graphs of historical ventilation conditions can be:
  - ❖ included in fire- or smoke-management plans.
  - ❖ used to illustrate concerns in public meetings.
  - ❖ overlain with other values at risk.
- The data can be used to help develop plans for avoiding smoke impacts and optimizing the use of prescribed fire at specific places or certain times of year.
- Spatial patterns of risks to air quality and visibility are illustrated in maps of monthly averaged values.
- Frequency statistics at selected points show temporal dimension of risk.
- Values at risk can be assessed for specific airsheds and compared over time or with other airsheds.

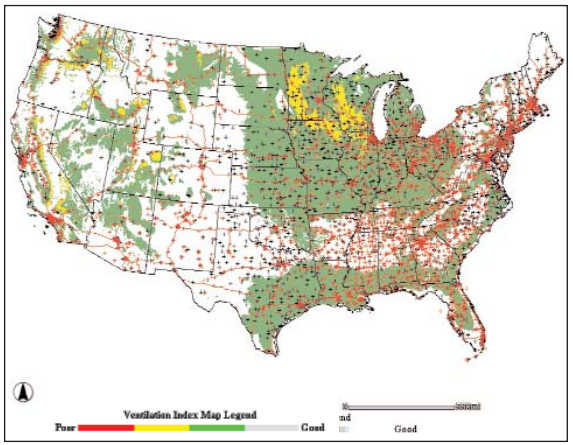
VCIS offers the first quantitative planning tool for smoke management that is nationally consistent.

What is VCIS?

The ventilation climate information system (VCIS) allows users to assess risks to values of air quality and visibility from historical patterns of ventilation conditions.

It is available through an interactive, Internet map server. The Internet server allows maps of ventilation potential to be overlain with sensitive receptors, terrain features, or political boundaries. The data apply to local, regional, or national scales.

Historical patterns of ventilation conditions are available through an interactive, Internet map server.



Average ventilation index for February afternoon with sensitive receptors (hospitals, airports, and roads).

FERA
Fire and Environmental Research Applications

Contact information:
Sue A. Ferguson (206) 732-7800
sferguson@fs.fed.us

USDA Forest Service
Pacific Northwest Research Station
Fire and Environmental Research Applications Team
4043 Roosevelt Way NE
Seattle, WA 98105

USDA United States Department of Agriculture
Forest Service
PNW Pacific Northwest Research Station

VENTILATION CLIMATE INFORMATION SYSTEM

A Management Tool for Smoke and other Pollutants

The VCIS is available at
http://www.fs.fed.us/pnw/fera/vent

Joint Fire Science Program

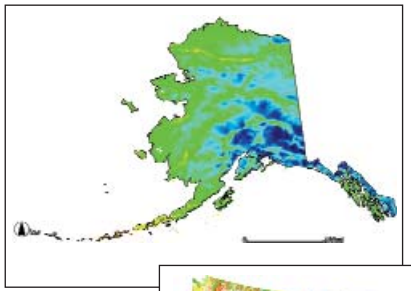
Joint Fire Science Program

February 2002

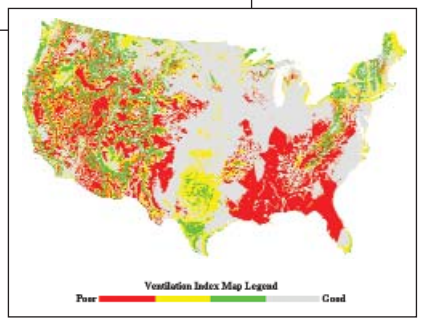
What's Inside VCIS?

The VCIS is based on a 40-year database that includes twice-daily values of wind, mixing height, and a ventilation index that is the product of wind speed and mixing height. Data are spatially interpolated to a grid of about 5 kilometers on a side.

The VCIS offers the first nationally consistent maps of surface wind and ventilation index ...

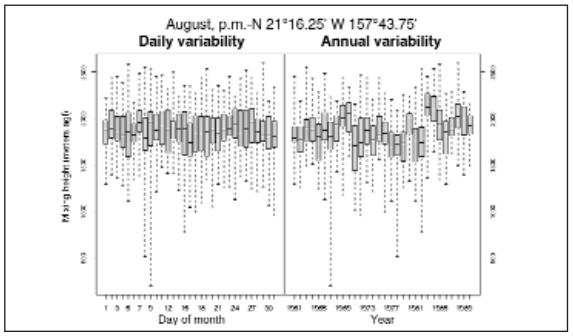


Average wind speed for July afternoon.



Average ventilation index for June morning.

...and includes the longest climate record of mixing height in the country.

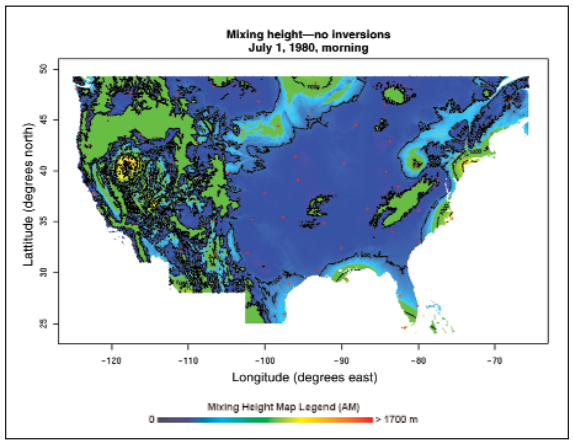


Frequency of mixing heights over a point near Honolulu.

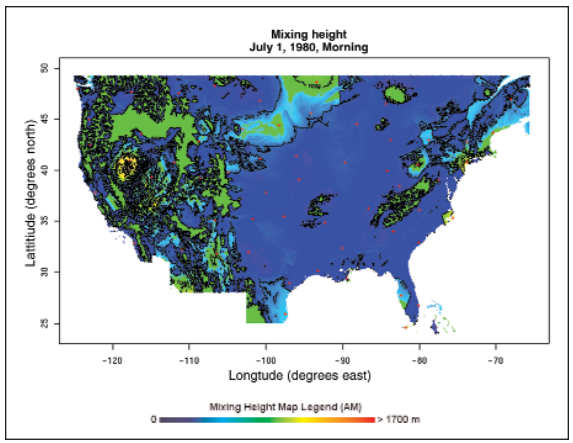
The Science Behind VCIS

Wind: Surface winds were generated with a reliable, well-documented meteorological model. The best available upper-air data were used as inputs to the model. Surface observations were used to verify the model. At every observation point, users can evaluate model performance and estimate uncertainty for themselves.

Mixing Height: A standard parcel method was used to calculate mixing height from upper air and surface observations. Mapped values that intersect high terrain were adjusted to well above ground level.



Mixing heights.



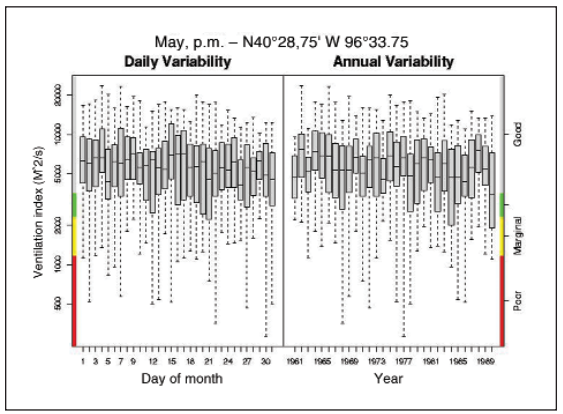
Mixing heights adjusted for local inversions.

A unique set of algorithms were used to derive the likely timing and location of local nightime inversions. Mapped values of mixing height were adjusted to account for local inversions wherever and whenever they occur.

Ventilation Index: The surface wind speed times the mixing height gives an estimate of ventilation potential. The resulting index in VCIS is lower than is typical because it is influenced by local inversions and derived from winds at the surface instead of higher in the mixed layer.

Table 1—Range of ventilation indices corresponding to each ventilation class

Ventilation index *Meters per second*	Class
0-1175	Poor
1176-2350	Marginal
2351-3525	Fair
>3526	Good



Frequency of ventilation index over a point in southeast Nebraska.